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SUPPLEMENT NUMBER 7, 1 JULY 1974 - 30
JULY 1975

Rita S. McAllister

Naval Aerospace Medical Research Laboratory
Pensacola, Florida

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An annotated bibliography of reports for the period 1 July 1974 to 30 June 1975 initiated by the Naval Aerospace Medical Research Laboratory, Pensacola, Florida 32512. | | |

FORWARD

Documents published at the Naval Aerospace Medical Research Laboratory (NAMRL), since 1 July 1974 are included in this seventh annual supplement to the annotated bibliography of reports dated 30 June 1968.

All numbered reports have been approved for public release; distribution is unlimited. Requests for copies should be directed to the National Information Service (NTIS), Springfield, Virginia 22151. Requests for reprints of open literature documents should be addressed to the author.

Rita S. McAllister

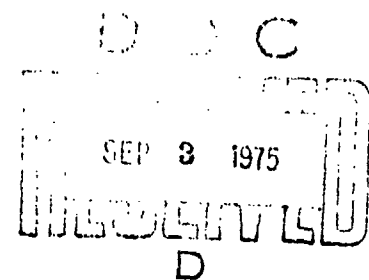


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*Denotes studies performed jointly with and supported by the United States Aeromedical Research Laboratory, Fort Rucker, Alabama.

Work Unit

MF51.524.002-5012DX5X.7
NAMRL-1207
(AD A003033)

Differentiating Aptitude Factors 8/23/74
Among Current Aviation Specialties

R. K. Ambler and M. J. Smith

Abstract:

An automated system of test construction is under development that involves accessing a large bank of test item data. In support of this development this study examined test material which, with the exception of a biographical inventory, covered a wide spectrum of cognitive abilities. The objective was to determine the kinds of test items that are most relevant for use in screening and classification for current aviation specialties, and thus to establish guidelines for investments into the test item bank.

By means of a series of factor analyses of test scores and criterion data five cognitive ability factors and a motivational factor were identified. The potential discriminatory validity of each factor was defined for the Naval Flight Officer (NFO) and pilot programs, and for various specifications within these programs.

The findings support the following recommendations:

1. Items measuring the classical triad of mechanical, numerical, and verbal abilities should be used; however, strong emphasis on verbal inputs into the item bank is not recommended.
2. Items measuring a Spatial manipulation factor should be emphasized

for pilots, and those measuring Numerical Intelligence should be emphasized for NFOs.

3. A Perceptual Flexibility factor should be explored further especially in view of its apparently unique association with helicopter performance.

4. Measures of the Flight Motivation factor as used in biographical inventories should comprise a significant input into the item bank.

MF51.524.004-5001BX5G.16
USAARL 74-11
NAMRL-1200
(AD 781881)

Individual Differences in Vestibular Information as a Predictor of Motion Disturbance Susceptibility 4/23/74

H.J. Moore and F.E. Guedry, Jr.

Abstract:

Certain facts suggest that motion disturbance may be related to the amount of vestibular information contributing to sensory conflict. Individual differences in motion disturbance susceptibility might, therefore, correlate positively with differential accessibility of vestibular sensory information to the spatial perceptual process. The results of two experiments, while not inconsistent with this hypothesis, did not demonstrate a relationship between a vestibular response variance measure and motion disturbance susceptibility at the conventional significance level. The test-retest reliability of the response variance measure was not found to be favorable. The slope of the vestibular stimulus-response relationship was not found to predict motion disturbance susceptibility.

MF51.524.004-5001BX5G.17
USAARL 75-2
NAMRL-1206
(AD A000079)

Some Effects of Alcohol on
Various Aspects of Oculomotor
Control

8/23/74

Fred E. Guedry, Jr., Richard
D. Gilson, David J. Schroeder,
and William E. Collins

Abstract:

Recent studies have shown that alcohol interferes with visual control of vestibular nystagmus. The present study was designed to assess three partially independent systems of oculomotor control. Performance on three tasks was measured before and after mild alcohol dosage. One task involved visual suppression of vestibular nystagmus; a second involved smooth oculomotor tracking of a moving target; and a third required repetitive rapid voluntary shifts in gaze. Oculomotor control was degraded on the first two tasks with recovery toward the initial performance level 4 hours after drinking. Performance on the third task was not obviously degraded, although it is possible that improvement with practice was retarded. Results are discussed in terms of neurological systems involved and kinds of flight tasks potentially affected.

MF51.524.005-7015BX8X.2
NAMRL-1215
(AD A009799)

Human Bioassay of Antimotion Sick- 4/2/75
ness Drugs

Ashton Graybiel, Charles D. Wood,
James Knepton, John P. Hoche and
Gene F. Perkins

Abstract:

Three experiments were conducted with the main object of improving a procedure for evaluation of anti-motion sickness drugs in human subjects. In previous experiments,

a constant level of stressful stimuli was generated by requiring subjects to execute standardized head movements at a predetermined angular velocity in a rotating room. The ceiling on the test (300 head movements) was often reached before the motion sickness endpoint. A second handicap in past experiments stemmed from the need to measure the effectiveness of a drug in terms of departures from a placebo baseline. Drugs and placebos were administered using a 10-unit Latin-square design and, although the placebo baseline was accurate for the group (10 subjects), the number and distribution of the placebos prevented drawing adequate placebo baselines for individual members of the group. In the experiments now reported an incremental increase in stressful stimuli was used, thereby reducing the number of failures to reach the motion sickness endpoint. By increasing the number of placebos (involving a modification of the Latin-square design) the accuracy of drawing placebo baselines was increased. Only drugs known to have antimotion sickness effectiveness were tested and the cardinal findings can be briefly summarized.

1. Great individual differences in response to antimotion sickness drugs administered in usual doses were revealed. In one experiment (involving 11 subjects and 7 drugs) the single best therapeutic response implicated all seven drugs tested (three single drugs and four fixed-dose combinations).
2. In terms of percentage of subjects demonstrating a substantial beneficial antimotion sickness drug effect, adminis-

tration of a fixed-dose combination of promethazine hydrochloride and ephedrine sulfate (25 mg each) proved to be outstanding; this combination of homergic drugs clearly exhibited a suprasummation effect.

3. A few tests were conducted using larger than usual doses and the results support previous findings that for a maximal beneficial effect in response to a single dose, individuals may vary both with regard to the choice of drug and the amount administered.

MF51.524.005-7016DE1G.1
USAARL 75-6
NAMRL-1209
(AD A004189)

Orientation-Error Accidents in Regular Army Aircraft During Fiscal Year 1971: Relative Incidence and Cost 11/18/74

W.C.Hixson and Emil Spezia

Abstract:

This report is the fifth in a longitudinal series of reports dealing with the pilot disorientation/vertigo accident problem in Army fixed wing and rotary wing flight operations. Incidence and cost data presented for fiscal year 1971 include a total of 50 major and minor orientation-error accidents (25 of which were fatal), resulting in 65 fatalities, 67 non-fatal injuries, and an over-all aircraft damage cost of \$11,404,119. The contribution of rotary wing accidents to this total was 47 accidents (23 of which were fatal), resulting in 62 fatalities, 67 nonfatal injuries, and an over-all aircraft damage cost of \$11,191,377.

MF51.524.005-7016DE1G.2
NAMRL-1212
(AD A009769)

Frequency Response of the Oculovestibular System During Yaw Oscillation 12/8/74

W. Carroll Hixson

Abstract:

The report describes the results of a system transfer function type study of the oculovestibular response to sinusoidal

yaw angular oscillation of the head. Ten naval aviator candidates were exposed to Earth-vertical rotation about the z head axis at nine different, octave-separated stimulus frequencies covering the 0.005 to 1.28 Hz spectrum with peak velocity of the stimulus held constant at 50 deg/sec. The frequency dependence of the oculovestibular system was interpreted in terms of phase and amplitude measures of the slow component eye velocity element of the resulting horizontal nystagmus. Though the phase data collected at the lower stimulus frequencies deviated somewhat from those predicted by the conventional second-order model of cupula-endolymph response, a theoretical account for the deviation was postulated by introducing an adaptation transfer function as developed by other investigators. An adaptation time constant of 100 sec was found to best fit the raw phase data, using two different phase selection criteria. With this modification of the raw phase data, it was predicted that the lower corner frequency of the cupula-endolymph system is approximately 0.0085 Hz (a long time constant of 19 sec). Brief discussion is presented of an unexplained peak in nystagmus beat frequency at 0.16 Hz and apparent conflicts in the amplitude data at the higher stimulus frequencies.

Work Unit

MF51.524.005-7026BA1J.1
USAARL 74-12
NAMRL-1202

Major Orientation-Error Acci- 6/5/74
dents in Regular Army UH-1
Aircraft During Fiscal Year
1970: Accident Factors

W. Carroll Hixson, Jorma I.
Niven and Emil Spezia

Abstract:

This report is the fourth in a longitudinal series of reports dealing with the pilot disorientation/vertigo problem in Regular Army UH-1 helicopter operations. Individual case history data extracted from the USAAVS master aircraft accident files are presented on major orientation-error accidents that occurred in UH-1 aircraft during fiscal year 1970. Summary data listings involving a variety of operational and pilot-related accident factors are presented for each of the 42 cases. The listings are arranged to distinguish between those factors and events present before takeoff, i.e., the initial conditions associated with a given accident, and those which occurred or were manifested during the actual airborne phase of the accident flight.

MF51.524.005-7026BA1J.2
NAMRL-1205
(AD 786370)

Disorientation Phenomena in Naval 7/29/74
Helicopter Pilots

Felix R. Tormes, and Fred E. Guedry, Jr.

Abstract:

The incident of pilot disorientation in fixed and rotary wing aircraft has been previously investigated, but special orientation problems of naval helicopter pilots engaged in operations at sea and landing on moving platforms have not been previously reported.

A questionnaire concerning disorientation was answered anonymously and individually by 104 active naval helicopter pilots. Fifty-six percent indicated one or more episodes of severe disorientation and 8.5 percent indicated having experienced severe disorientation five or more times while piloting helicopters. A number of factors conducive to disorientation were identified. Some precipitating factors appear to be specific to operations over water or over a moving deck, although some of these may well have their counterparts in special operations over land. Other factors are common to land- and sea-based operations and some are common to fixed-wing as well as rotary-wing aircraft.

A number of potential countermeasures for various precipitating factors are discussed.

MF51.524.015-0012BE7X.3
NAMRL-1211
(A.D. A003948)

A Primate Restraint Chair for Use in 9/11/74
Microwave Radiation Studies

Vernon R. Reno, John O. deLorge,
George D. Prettyman, Clayton S. Ezell
and Toby A Griner

Abstract:

A restraint chair has been developed for use with subhuman primates in microwave research. The chair is essentially nonreflective, causing minimal perturbation of the field incident on the restrained animal.

MF51.524.015-0013BE7X.6
NAMRL-1195
(AD A005898)

The Effect of Extremely Low Frequency August 1974
Magnetic Fields on Human Performance:
A Preliminary Study

R.S. Gibson and W.F. Moroney

Abstract:

Interest in the development of an extremely low frequency (ELF) communications system for naval use has

resulted in a program to determine the effects of such fields on man. This report represents part of pilot level effort to develop a set of tests and procedures for determining whether ELF fields have any measureable effects on human memory and psychomotor functions.

Four tests were used to measure performance before, during, and after a 24-hour exposure to a low intensity magnetic field of 10^{-4} Wb/m^2 at 45 Hz. The tests used were: the Response Analysis Tester (RATER), the simplified electronic tracking apparatus (SETA), the Wilkinson Adding Task, and the Minnesota Rate of Manipulation Test (ROM). The results were analyzed at three levels: (1) a gross analysis by test type comparing the performance measures obtained before, during, and after ELF exposure; (2) a micro analysis of the session-by-session performance changes for each of the tests; (3) a test session by test session analysis of performance for each of the experimental subjects.

None of the test revealed significant performance decrements under the gross analytical conditions. The Wilkinson Adding Task uncovered significant performance decrements during the second of two testing sessions while being exposed to the ELF magnetic field. One of the RATER conditions exhibited a significant improvement in performance. One subject had a significantly bad session in which his performance declined on 6 out of 7 measures; however, this performance appeared to be unrelated to other psychological or physiological data.

In view of the large number of statistical analyses performed on a limited amount of data, the few significant performance

decrements must be interpreted with extreme caution. They identify techniques to be replicated in future research and nothing more. Individual differences in test performances were large, any effects due to the exposure to ELF magnetic fields were small; consequently, special consideration should be given to the possibility of using an exposure-reexposure experimental design in any future experiments.

MF51.524.015-0013BE7X.7 Search for Effects of 45 Hz Magnetic 1/15/75
NAMRL-1197 Fields on Liver Triglycerides in
(AD A007514) Mice

D. E. Beischer and R. J. Brehl

Abstract:

Extremely low frequency electromagnetic fields play a considerable role in military and civilian use of electric power and in communication systems. The present study is part of a series of investigations conducted at NAMRL to examine biological effects of such fields.

Liver triglycerides in mice exposed to a 45 Hz magnetic field for 24 hours were not significantly different from control values. No differences in body weight, liver weight or liver water content were detected either.

MF51.524.015-0014BX7X.4 A Psychobiological Study of Rhesus 5/16/74
NAMRL-1203 Monkeys Exposed to Extremely Low
(AD A000078) Frequency-Low Intensity Magnetic
Fields

John de Lorge

Abstract:

Four rhesus monkeys were exposed to magnetic fields between 8.2 and 9.3 $\times 10^{-4}$ T alternating at 45 Hz and 15 Hz in a series of four studies. Associated electric fields were minimal. The monkeys displayed no reliable changes in performance analogous to timing behavior, nor were there indications that the

animals could detect the fields. No consistent hematological changes were found to relate to the fields.

MR041.01.01-0120B8FG.13
NAMRL-1204
(AD 786288)

Elicitation of Vestibular Side effects 7/29/75
by Regional Vibration of the Head

James R. Lackner and Ashton Graybiel

Abstract:

Vestibular side effects including visual and postural illusions, nystagmus, and motion sickness were elicited using a vibrator (held either by the subject or experimenter) applied to different regions of the head. Although a commercially available vibrator (60 Hz, 120 pulses/sec) can elicit side effects, its use was enhanced by varying the vibration frequency and optimizing the stimulus conditions for perception of illusions and elicitation of motion sickness. Both horizontal and vertical nystagmus were elicited, the latter inconsistently. A strong apparent movement (and displacement) of a dimly lighted target that resembled the oculogyral illusion and apparent self-motion were consistently elicited. Motion sickness was readily elicited in some subjects but in other subjects even stimulation during rotation failed, although the period of stimulation was brief. The findings indicate that the use of vibratory stimulation should be exploited to determine whether, in addition to its use in the laboratory as a research device, it has a place in the clinic as a means of evaluating canalicular function.

M4305.08-3012DAD1.1
USAARL 75-7
NAMRL-1210
(AD A004963)

The Brief Vestibular Disorientation 10/16/74
Test as an Assessment Tool for
Non-Pilot Aviation Personnel

Rosalie K. Ambler and Fred E. Guedry, Jr.

Abstract:

Past research has demonstrated the value of the Brief Vestibular Disorientation Test (BVDI) as a screening tool for student pilots. This study is concerned with the extension of this technique for use in assessing the potential Naval Flight Officer (NFO).

The rater BVDI procedure was used here, and in addition, a performance task involving a short-term memory task in the auditory mode was introduced in order to measure performance decrement. Representative groups of entering NFO students were first administered the performance task under the exact conditions of the previous BVDI procedure, but without rotation. After a 2-minute rest period, the procedure was repeated with rotation. Observer assessments were made during this rotation sequence. The results indicate that those students who later failed NFO training exhibited greater performance decrement under rotary conditions as compared to static than did successful students. Rater-type BVDI scores also indicated slightly greater sensitivity (.07 level of significance) to the vestibular stimulus for the failures than for the successes. It was concluded that this technique is of value in screening NFO's.

NASA T-43310G
NAMRL-1208
(AD A001026)

Criteria for Personal Dosimetry in
Mixed Radiation Fields in Space

9/16/74

Hermann J. Schaefer

Abstract:

As manned space missions are becoming routine operations, the complex arsenal of instruments for personal radiation monitoring ought to be simplified. The necessary compromises concerning accuracy and completeness of record should be carefully evaluated. The report analyzes

the dosimetrically relevant parameters of the three main contributions to the astronaut's radiation exposure in space: trapped protons, tissue disintegration stars, and neutrons. It is shown that interference and superposition effects from different components impose certain principal limitations on resolution. Possible ways and means for a system of restricted dosimetry which would record only certain parameters and establish the total dose equivalent from known characteristics of the radiation field are discussed.

NASA W-13280
NAMRL-1214
(AD A010220)

Microdosimetric Structure of HZE Particle Tracks in Tissue 4/8/75

Hermann J. Schaefer

Abstract:

Heavy nuclei of the primary galactic radiation in space (HZE particles) can have the same Linear Energy Transfer (LET) yet greatly different lateral distribution patterns of the energy in the microstructure of tissue. Track structure thus presents itself as a new dosimetric parameter for HZE particles which is at present incompletely understood in its radiobiological significance. While the microscopic image of a particle track in nuclear emulsion conveys some information on track structure, a complete analysis has to rely on theory. The theory of track structure distinguishes two regions: core and penumbra. The core is a narrow region with a radius far below 1 micron in tissue where energy deposition occurs mainly through excitations and collective oscillations of electrons. Energy density in the core is enormous accounting for slightly more than half the total LET. The penumbra surrounding the core extends laterally several to many microns depending on the energy of the primary. Energy density in the penumbra decreases steeply with the square of increasing radius. The relationships are illustrated with nuclear emulsion

micrographs and plots of energy density profiles. The implications of the findings for a dosimetric system for HZE particles are discussed.

Special Reports

MR041.01.01-0133D1DX
NAMRL 74-1
(AD A003073)

Hyperbaric-Hypobaric Interactions November 1974
As They Relate To Compressed Air
Diving And Aviation: Canine Ex-
periment

James L. Kupper, Walter P. Trevethan,
and Richard J. Brown

Abstract:

To confirm or refute the existing regulation requiring a 24 hour interval between diving and flying, dogs were exposed to increased ambient pressures equivalent to water depths encountered in normal professional and recreational diving. The animals were subsequently exposed to reduced pressures comparable to those experienced by naval aircrew members. Various times between hyperbaric and hypobaric episodes were evaluated. The experimental animals were examined using the following methods: (1) Clinical signs; (2) clinico-pathologic determinations; (3) pulmonary interstitial fluid volume; (4) gross pathology; and (5) light microscopy. Evidence of decompression sickness was found. Insofar as the findings may apply to man, a period of greater than 12 hours should elapse between diving and flying. An experimental animal species more closely related to man is being examined in larger numbers to precisely define the safe interval.

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